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ABSTRACT

Older persons (55 years and older) with cardiovascular disease are at increased risk for hospital readmission when compared to other subgroups of our population. This issue presents an economic problem, a concern for the quality and type of care provided, and an urgent need to implement innovative strategies designed to reduce the rising cost of medical care. This study attempted to identify risk factors for the prediction of those individuals at risk for non-elective hospital readmission for the same disease. A multifactorial assessment was performed on a group of cardiovascular diseased patients (N=121). Over the course of 90 days after their initial discharge, the incidence of non-elective readmissions was observed in order to determine: (1) the frequency of readmission; (2) the ability to predict readmissions; and (3) if the identified risk factors have implications for rehabilitation intervention. Findings indicated that two variables--happiness and physical health--contributed to the prediction of older persons at risk for nonelective hospital readmission. Persons reporting worse physical health, and lower levels of happiness were more likely to be rehospitalized during the 90-day follow-up period. Of seven factors, four were univariate significant predictors of admission status: number of secondary disorders, physical health, personal adjustment, and happiness. The following recommendations are made for further study: (1) the replication of this study utilizing a larger sample would provide opportunities for cross-validation of the results; (2) more data are needed regarding acceptable readmission rates for a cardiac care unit; prospective studies are needed to better define the patient population within this specific patient category; (3) the extent to which the predictive power of the model could be improved through consideration of additional factors should be examined; (4) the practical benefits of a model such as this needs to be evaluated in an on-site trial; and (5) the use of other instruments measuring morale may add to the amount of information available about one's life satisfaction or subjective well-being. (LLL)

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IDENTIFYING RISK FACTORS FOR THE PREDICTION OF HOSPITAL READMISSION AMONG OLDER PERSONS WITH CARDIOVASCULAR DISEASE

Health care costs have become a major economic concern in this country. In 1986, for example, total health care expenditures reached a level of $458 billion and is expected to approach $650 billion in 1990 (Russell & Manning, 1989). The largest share of these health care dollars is for inpatient or hospital care expenditures, which in 1986 accounted for $180 billion or 39% of the total health care dollars. This figure excludes physicians' fees incurred during the hospital stay (National Center for Health Statistics, 1988). It is therefore of little surprise that major attention is now being directed towards containment of medical cost.

One area of medical cost that needs close examination is hospital readmissions. Between 1974 and 1977, for example, Medicare alone expended over $600 million and $2.5 billion per year on patient readmissions within five and 60 days of discharge, respectively (Anderson & Steinberg, 1984). This expenditure problem is further pinpointed by the fact that only a minority of readmitted patients consume most of the readmission dollars. These "high cost" users are largely those readmitted for the same disease, rather than those with single cost-intensive stays or prolonged single hospitalizations (Schroeder, Showstack, & Roberts, 1979; Zook & Moore, 1980). Those illnesses or diseases accounting for the largest proportion of repetitive hospitalizations for the same diseases are: diseases of the respiratory system, cancer, renal failure, diabetes, chronic lung disease, and diseases of the circulatory system (Smith, Norton, & McDonald, 1985; Zook & Moore, 1980). It is this latter category, diseases of the circulatory system or heart, that also accounts for the greatest number of hospitalizations among individuals 65 years of age and older (National Center for Health, E.J. Graves, 1985). As such, older persons represent a major portion of those individuals in this and other medical high cost groups (Zook & Moore, 1980). This fact takes on added significance with future implications, given that the number of older persons is increasing at a more rapid rate than any other age group in

the United States. Specifically, current projections indicate that this growth will continue, and that individuals over 65 years of age will increase from a current 12% of the population to approximately 22% by the year 2030 (U.S. Bureau of Census, 1988). Therefore, there is every reason to expect that these costly readmissions for older persons with diseases of the circulatory system will only increase.

Several factors are believed to have an effect on an individuals risk for readmission. One such factor is the patients initial length of stay in the hospital. In other words, patients may be adversely affected if discharged too soon. This is an especially critical matter given that Medicare now has a cost-containment policy which forces hospitals and their physician staffs to implement a payment system designed to reduce length of stay, possibly even at the potential expense of the patient's quality of care and future medical cost.

This Federal policy, which is intended to control overall hospital cost, is referred to as the prospective payment system (PPS). Initiated in 1983, the PPS policy is one in which payment for each Medicare hospitalization is determined by the patients diagnosis at discharge. Specifically, the rate is fixed in advance for each admission in each diagnosis-related group (DRG), and adjusted according to whether hospitals are located in urban or rural areas (Wennberg, McPherson, & Caper, 1984). One goal of this legislated policy was to discourage lengthy hospital stays and to encourage physicians to utilize the less expensive outpatient arena to deliver care (Smith, Norton, & McDonald, 1985). Given this fact, the length of stay for a patient in the hospital could quite possibly have a bearing on that patient's risk for readmission.

In addition to length of stay, other factors may also effect an individual's total post-hospital recovery, and thereby, risk for readmission. For some older persons with heart disease, a hospital readmission may exacerbate their worst fears, i.e., a loss of independent physical functioning, heightened dependency on family members, and concomitant loss of self-esteem. Therefore, older persons with cardiac disease may also be at increased risk for repeated and frequent readmissions to the hospital because of the severity of their illness, especially when it is combined with various other medical complications, and the impact of the psychological and social stresses on the disease course and recovery (Berkman &

Abrams, 1986; Berkman, Dumas, Gastfriend, Poplawski, & Southworthe, 1987). Consequently, multiple readmissions may intensify the complex interplay between the medical, psychological, and social factors affecting the patient, family, and caregivers. Hospitalization, discharge, and readmission are not only emotionally difficult to handle, but they may also increase the risk of the patient becoming confused, disoriented, and less able to manage the post-hospital adjustments necessitated by the disease or condition (Hunt & Gunter-Hunt, 1983; Neugant, 1981).

Weinberger, Darnell, Tierney, Martz, Hiner, Barker, & Neill (1986) support the idea that characteristics of individuals within certain diagnostic categories may bear a statistical relationship to repeated hospitalizations within a short period. Identification of these characteristics is essential if rehabilitation professionals are to be successful in the planning, development, and coordination of successful rehabilitation strategies and services to reduce hospitals excessive reliance on institutional or inpatient care. Although considerable information is available on average use of hospitals by older persons, we lack detailed information regarding hospital use by individuals within specific diagnostic categories such as cardiac disease. Research efforts might effectively focus on specific variations within these diagnostic categories, rather than on average use of hospitals by older persons (Gooding & Jette, 1985).

In a recent study, it was found that the PPS not only has reduced Medicare's hospital costs substantially, but this reduction has not been offset by higher expenses for outpatient services (Russell & Manning, 1989). This information is positive because if high-risk patients can be predicted early during hospitalization, rehabilitation professionals can target their efforts to work with these patients following discharge on an outpatient basis, thus minimizing the chance of, and possible avoiding, hospital readmissions.

Statement of the Problem

For several reasons, the increasing numbers and proportion of older persons in our population will continue to have an important impact on future health-care costs in this country. First, persons 65 years of age and over are found to be disproportionately

represented in these medical high-cost groups (Zook & Moore, 1980). Secondly, medical care expenditures are highly concentrated on a small percentage of beneficiaries who are hospitalized repeatedly, often for the same disease (Anderson & Steinberg, 1984). The prevention of premature or avoidable readmissions to the hospital among older persons with cardiac disease should be a major concern in discharge planning (Smith, Norton, & McDonald, 1985). Thirdly, repeated hospitalizations for the same disease accounts for nearly 60% of all hospital charges, thereby establishing a multiplier of national health care costs (Zooks, Savickis, & Moore, 1980). Fourthly, a high percentage of hospitalizations are followed by non-elective readmissions within short periods of time following discharge, over 5% within five days of discharge, and over 22% within 60 days (Anderson & Steinberg, 1984). Successful identification and prediction of those individuals at risk for non-elective hospital readmission might serve to assist rehabilitation professionals in playing a vital role in patient evaluation, coordination, and provision of outpatient services in cardiac rehabilitation aimed at reducing these risk factors (Deutsch & Sawyer, 1988). Generally then, what is known is that older persons with cardiovascular disease are at increased risk for hospital readmission when compared to other subgroups of our population. Readmissions are expensive. The cost can range from 24 to 55% when compared to the individual's first hospitalization (Berkman & Abrams, 1986). These points present an economic problem, a concern for the quality and type of care provided, and an urgent need to implement innovative strategies designed to reduce the rising cost of medical care.

Purpose of the Study

The purpose of this study was to identify risk factors for the prediction of those individuals at risk for non-elective hospital readmission(s) for the same disease i.e., cardiovascular disease among older persons 55+ years of age. A multifactoral assessment was performed on a group of cardiovascular diseased patients, i.e., Acute myocardial infarction (AMI), Atherosclerotic heart disease (AHD), Atrial fibrillation (AF), Congestive heart failure (CHF), and Unstable angina (UA). Over the course of 90 days after their

initial discharge, the incidence of non-elective readmissions was observed in order to determine (a) the frequency of readmission, (b) the ability to predict readmissions, and (c) to determine if the identified risk factors have implications for rehabilitation intervention. The readmission time frame of 90 days exceeds the course of illness definition used by many health insurance programs which consider that readmission within two months (60 days) represents the best criteria for identifying preventable problems (Anderson & Steinberg, 1985).

Acknowledging that a small proportion of patients have repeated morbidity requiring hospitalization raised the following specific research questions:

1. Does the initial length of stay in the hospital, for selected cardiac patients 55 years of age and over, predict readmission for the same disease within a short period of time (90 days)?

   HØI: No significant relationship will be observed between readmission rates within a short period of time (90 days) and initial length of hospital stay among the selected cardiac patient categories.

   HØII: No significant relationship will be observed between readmission rates within a short period of time (90 days) and initial length of hospital stay between the selected cardiac patient subgroups from each diagnostic category.

2. Are cardiac patients with complicated illnesses (greater than three secondary diagnoses) more likely to have increased rates of readmission, than those with less complicated illnesses (nor more than three secondary diagnoses)?

   HØIII: There will be no significant difference in readmission rates among persons with complicated illnesses when compared to persons with less complicated illnesses.

3. Are there differences in the proportion of variance in the dependent measures accounted for by the individual predictors?

   HØIV: There will be no difference in the proportion of the variance accounted for by the combination of the Physical Health and Activities of Daily Living subscales of the Multilevel Assessment Instrument (MAI) and that accounted for by the MAI, Affect Balance Scale (ABS), and Hope Scale indicators of personal adjustment in predicting hospital readmission within ninety days.

HØV: There will be no difference in the proportion of the variance accounted for by the Physical Health indicator subscale of the MAI and that accounted for by the MAI, ABS, and Hope Scale indicators of personal adjustment in predicting hospital readmission within ninety days.

HØVI: There will be no difference in the proportion of the variance accounted for by the Activities of Daily Living subscale of the MAI and that accounted for by the MAI, ABS, and Hope Scale indicators of personal adjustment in predicting hospital readmission within ninety days.

HØVII: There will be no difference in the proportion of the variance accounted for by the combination of the Physical Health and Activities of Daily Living subscales of the MAI and that accounted for by the Hope Scale indicator of personal adjustment in predicting hospital readmission within ninety days.

HØVIII: There will be no difference in the proportion of the variance accounted for by the combination of the Physical Health and Activities of Daily Living subscales of the MAI and that accounted for by the ABS indicator of personal adjustment in predicting hospital readmission within ninety days.

*All hypotheses were tested at the .05 level of significance.

Significance of the Study

The study of hospital recidivism for patients with circulatory problems related to specific types of heart disease has several major implications and/or objectives. Having established that there are predictable high cost groups of repeater patients with particular illnesses, the identification of risk factors for non-elective hospital readmission for repeater patients, already diagnosed as having heart disease, might serve to reduce these admissions. Identification of those patients at risk for readmission may well achieve major cost savings to Medicare and other payers of health care. It is estimated that if one could effect a 20% decrease in the readmission rate, approximately 11 billion health care dollars per year could be saved (Berkman & Abrams, 1986). Secondly, greater attention paid to identifying, profiling, and predicting individuals at increased risk for hospital readmission could serve to channel recidivist patients down the most cost-effective long-term track of care i.e., outpatient services in cardiac rehabilitation. Thirdly, public policy programs for

health insurance or cost control programs similar to those utilized by Medicare and Medicaid (reimbursement provided on a preestablished rate based on the Diagnosis-Related Group) should include provisions based on levels of risk for readmission and characteristics that appear to be correlated with the probability that high-risk patients will/will not be readmitted within a short interval after discharge (Gooding & Jette, 1985). Fourthly, if identification of at risk characteristics for repeated admissions among predictable high cost groups can be achieved, these data can supply rehabilitation professionals with the necessary information needed for the design of comprehensive and intensive cost effective interventions in cardiac rehabilitation. Finally, these rehabilitative intervention strategies may be successfully utilized in the community reintegration of the older person from the hospital to their home or other independent living settings.

Limitations

Data obtained may underestimate the true prevalence of the specified diagnostic categories among hospitalized older persons because, even if present, the specified diagnostic categories might not be identified as the primary reason for hospital stay. Another limitation is the possible underestimation of the overall rate of hospital readmission because only those readmissions made to the same hospital were recorded. If a patient was readmitted to another hospital or died during the three-month study period, this information would not have been captured. Also, since follow-up is limited to 90 days, the total incidence of readmissions for this group may be even higher. Finally, the hospitals used in this study are all short stay hospitals serving rural communities, therefore, the populations they serve are expected to maintain similar demographic characteristics.

8

FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

An understanding of this research effort requires a summary, conclusions, implications for the profession, and recommendations. Specific sections to be discussed include an introduction, statement of the purpose of the study, research questions, review of the population, methods and procedures, presentation of the findings, conclusions, implications, and recommendations for further study related to the prediction of those individuals at risk for nonelective hospital readmission.

Purpose of the Study

The purpose of this study was to begin the process of identifying risk factors for the prediction of early non-elective hospital readmission among older persons with specific types of cardiovascular disease.

The research questions investigated in this study were the following:

1. Does the initial length of stay in the hospital, for selected cardiac patients 55 years of age and over, predict readmission for the same disease within a short period of time (90 days)?

2. Are cardiac patients with complicated illnesses (greater than three secondary diagnoses) more likely to have increased rates of readmission, than those with less complicated illnesses (no more than 3 secondary diagnoses)?

3. Are there differences in the proportion of variance in the dependent measures accounted for by the individual predictors?

Review of the Sample

The sample was drawn from patients admitted to two hospitals, East Alabama Medical Center in Opelika, Alabama; and HCA Parkway Medical Center in Lithia Springs, Georgia. Of the 130 individuals who agreed to participate in the study, 121 completed both phases of

the data collection process. One respondent decided to withdraw their consent and discontinue participation in the study during the second phase of the study. Eight other persons died before completion of the second phase of the study. In the first phase, information was gathered from hospital medical records. In the second phase, patients were mailed data collection packets which included the following three standardized test instruments: a) the Multilevel Assessment Instrument, b) the Affects Balance Scale, and c) the Hope Scale.

The outcome variable, hospital readmission status, was gathered from computerized and manual chart audits, and indicated that 50 respondents experienced no readmission, while 71 respondents were noted to have experienced a readmission.

Methods and Procedures

After having obtained consent to gather information from each participants medical record, each patient was mailed a data collection packet containing the Multilevel Assessment Instrument (MAI), the Affects Balance Scale (ABS), the Hope Scale, and an addressed, prepaid, return envelope. The MAI systematically assesses behavioral competence in the domains of health, activities of daily living, cognition, time use, social interaction, psychological wellbeing, and perceived environmental quality. The ABS is a reliable and valid measure of happiness, while the Hope Scale is based on interactions of wishes and expectations and measures morale or future referenced events. Following this first mailing, a follow-up phone call was made to each individual receiving the instrument one week after the initial mailing. A second copy of the instrument was sent to each person who had not yet responded three weeks after the initial mailing.

In order to investigate the research questions of this study, the statistical procedure of multiple discriminant analysis was used for the analysis of individual scores. Three variables were chosen from individual scale values of the MAI. Two other variables were chosen from information available from hospital medical records. A sixth independent variable, happiness, was chosen from the ABS scale. The final variable, morale, was chosen from the Hope Scale. The dependent variable was one's readmission status, one

group or model represented those individuals who were readmitted, and the second model or group represented those individuals who had not experienced a readmission.

Presentation of Findings

For each research question, the following results were obtained:

Research Question 1: The procedure used in this analysis was the Pearson product-moment correlation. Rate of readmission(s) was correlated with initial LOS, and patients with selected types of heart disease. There was a lack of correlation between readmission rates and a patients initial LOS (r=.039). In addition, no signification correlation was observed between readmission rates and length of stay, regardless of the type of heart disease one possessed (r=.045). Therefore, the null hypothesis is accepted.

Research Question 2: The Student's t-test with a two-tailed probability was used in this analysis. In this instance, it was used to test independent samples i.e., different groups of cases. An independent-samples test divides the cases into two groups and compares the group means on a single variable. The criterion for dividing the cases into two groups was the number of secondary disorders (uncomplicated vs. complicated). The group means were compared to the variable, rate. This procedure led to a t-value of .09, with 69 degrees of freedom, and a significance level of .93. Hence, the number of secondary disorders i.e., "complications", appeared to have little effect on rates of readmission, therefore, the null hypothesis is accepted.

Research Question 3: Standardized coefficients were obtained to determine the value of particular variables dependent on the other variables in the function. Happiness is the variable with the highest contribution to the discriminant function, followed by number of secondary disorders, physical health, length of stay, self-hope, personal adjustment, and activities of daily living. In Hypothesis VIII, the only analysis in which the overall F proved to be significant, happiness was the variable with the highest contribution to the discriminant function, followed by physical health. The discriminant weights were .68064 and .54234, respectively. The null hypothesis was rejected for each of these hypotheses.

Conclusions

Findings indicated that two variables, happiness and physical health, contributed to the prediction of older persons at risk for nonelective hospital readmission. Persons reporting worse physical health, and lower levels of happiness were more likely to be rehospitalized during the 90 day follow-up period. Of seven factors, four were univariately significant predictors of admission status: number of secondary disorders, physical health, personal adjustment, and happiness. Several conclusions can be drawn from these findings.

First, while the MAI appears to be a reasonable, broad-based assessment instrument, it should be supplemented by a scale specifically designed to measure areas of personal adjustment such as an individuals happiness and/or morale. The Affect Balance Scale appears to provide data, regarding an individuals happiness, not obtainable through the MAI's personal adjustment domain. It is interesting to note that although there was no significant difference in the self-hope or morale scores of the Hope Scale between those who were readmitted and those who were not, a large percentage of these scores were low, regardless of readmission status. This would indicate that the majority of the patients did not feel very positive with regards to future self referenced events in their life (See Appendix I for specific questions). This factor should not be overlooked, as it may be useful in identifying persons, regardless of readmission status, who may be in need of socio-emotional support. A telephone conversation between this researcher and Sara Staats, the developer of the Hope Scale, indicates that in a sample of 142 well older persons who participated in a study she conducted for AARP, a mean score of 141.21 was obtained, with a standard deviation of 33.82. In this present study, scores were much lower. A mean of 111.86 was obtained, with a standard deviation of 49.64. These lower scores in morale on the Hope Scale for this present study with regards to this patient population, warrants further exploration.

Second, 58.7% of the respondents in this study were rehospitalized. According to findings in the literature, the rate of hospital recidivism ranges from 17 to 41 percent, depending on the primary diagnosis of the patient and the time period analyzed. Readmission rates may be higher in this study because it focuses on one specific patient

population known to be an at risk population for repetitive hospitalizations. It stands to reasons that many readmissions among patients with cardiovascular disease are a result of unavoidable clinical deterioration. While a zero rate for readmission after discharge from a cardiac care unit would be desirable, it is not a realistic goal. Therefore, given the unique nature of this patient category, it should be ascertained as to what constitutes an acceptable readmission rate. There is little reported data on readmission rates to a cardiac care unit. Still, given the fact that many of these readmission are quite likely unavoidable, one must also accept that fact that many of these readmissions are also preventable, and may be due to factors such as inadequate medical management, non-compliance on the part of the patient to physician recommendations, social problems, and/or inadequate rehabilitation.

Third, while only two domains from the MAI are significant in the present analyses (physical health and personal adjustment), one cannot discredit the remainder of the MAI. Other domain scores may predict other outcomes such as life satisfaction, mortality, and/or the potential success of an individual in a cardiac rehabilitation program. Further, it is interesting to note that the MAI was also utilized by Weinberger et al., (1987). The variables, physical health and ADL, were shown to univariately significant predictors of hospital admission status among elderly public housing tenants.

Fourth, in this study, LOS had no effect on readmission rates. The LOS for the majority of patients (76.9%) did not exceed seven days, regardless of their readmission status. Hospital LOS has fallen regardless of patient payment source. It appears that there was little variability in the LOS in each patients hospital admission. This is likely due to hospitals desire to offset changes in Medicare's eligibility rules. The introduction of the prospective payment system (PPS) in 1983 means that hospitals are reimbursed for care based on the medically diagnosed medical condition of a patient, and a predetermined LOS set by Medicare for each medical condition. If hospitals are able to release patients before the predetermined LOS set by Medicare, hospitals are able to make a profit from these residuals. Consequently, as a result of Medicare's PPS, it appears that there is little variability in LOS. The PPS encourages a patients timely and early release from the hospital, and hospitals have begun relying on outpatient services to deliver care.

Interestingly enough, studies show that these savings are not offset by an increase in outpatient expenditures (National Association of Rehabilitation Facilities, 1989). To further expound on the increasing use of outpatient services and its effect of the variable LOS, it is interesting to note that the use of outpatient services has steadily increased since about 1986. So while LOS may have been a useful predictor in past studies (Lazar et al., 1987; Phillips et al., 1987; Smith et al., 1985), it appears that its current usefulness is impeded by the fact that today, very few patients will experience an initial LOS which exceeds 7-9 days. Those patients requiring post hospital recovery services are now regularly seen on an outpatient basis. Because of the success of many outpatient programs in cardiac rehabilitation, the median hospital stay form AMI, for example, has decreased markedly from 21 days in 1970 to 14 days in 1979 to only 9 days in 1987.

Finally, it was expected that the severity of ones illness would serve as a predictor of readmission. Although the number of secondary disorders was univariately significant, it was not a significant predictor in the discriminant function. This may be due to the fact that while this measure may have been helpful in predicting admission outcomes, by the time a patient reached the point of discharge, medical intervention would have neutralized some of the predictive power of this variable. Perhaps severity of illness should have been supported by other factors such as mean number of medications, number of previous emergency room visits, and percent having surgery. While Evans et al., (1988) had shown that having two or more chronic conditions was successful in predicting hospital readmission, the classification of four or more secondary or chronic disorders in this study proved to be unsuccessful. If a patient had four or more secondary disorders, it was classified as a "complicated" medical condition. Perhaps in this present study, a complicated disorder would have also been better classified as one having two or more secondary or chronic disorders.

Implications

The implications of having a predictive model which would successfully predict those individuals at risk for nonelective hospital readmission are numerous. Firstly, because

high-risk patients can be identified early with such an approach, discharge planners, during the course of hospitalization, can target their efforts toward those people at greatest risk. Although validation studies are still needed to refine further the discriminant function, the potential for a model such as this is evident.

Secondly, of particular concern in this study are the high rates of hospital readmissions. The data on readmission rates in this study may serve as comparison data for others interested in reviewing this issue in their own cardiac care units. The readmission rate for patients to a cardiac care unit may be a useful means to monitor for problems. The absolute percentage does not identify the specific problem but may serve to alert those individuals with responsibilities for quality assurance.

Thirdly, because one of the research objectives was to predict individuals at risk for hospital readmission in order to give them special help, it was also important to predict those individuals who would not experience a readmission. For respondents in the "no readmission" group, 44.9% were correctly classified and 55.1% were misclassified. What this means is that use of the discriminant function would lead to a large number of misclassifications among patients capable of continuing in their communities who were predicted to be readmitted. Thus, the function could also be useful in identifying patients who would not likely experience a readmission, but may be in need of socio-emotional support while continuing in their communities.

Finally, as hospitals attempt to reduce LOS to meet the mandate of tighter reimbursement formulas, they will need to focus attention on the specific post-hospital needs of this type of chronically ill population. Life satisfaction scales such as the Affect Balance Scale are designed to measure the range of optimism-pessimism, active involvement-boredom, personal responsibility-dependence, and achievement-failure for older individuals, and should be considered in future analysis. Post-hospital services targeted at high-risk patient groups such as patients with cardiovascular disease may have a strong impact on improving health care delivery. Life satisfaction has not been commonly collected at discharge, but its importance in this analysis suggests that emotional or mental outlook is a significant risk factor in predicting readmission.

Recommendations for Further Study

As previously discussed, studies have been conducted to predict hospital readmission. However, despite the financial impact of readmission, little is known about the factors that influence readmission among patients with cardiovascular disease, and no model exists that identifies patients within the specific diagnostic category of circulatory diseases. This study is unique in attempting to begin the process of developing a predictive model for the purpose of successfully identifying those individuals at risk for non-elective hospital readmission. Generalization from this study to the entire population of persons with the specific types of cardiovascular diseases used in this study should be done with caution. To ensure that a discriminant function is valid and generalizable beyond the sample in which it was initially derived, it should be cross-validated to determine the stability of the weights and the actual predictive accuracy of the equation. Discriminant loadings and the canonical correlation can shrink dramatically after cross-validation. Keeping this in mind, the following recommendations are made for further study:

1. The replication of this study utilizing a larger sample would provide opportunities for cross-validation of the results.

2. More data are needed regarding acceptable readmission rates for a cardiac care unit; prospective studies are needed to better define the patient population within this specific patient category.

3. The extent to which the predictive power of the model could be improved through consideration of additional factors should be examined. Because the model accounts for only 7 percent of the variance between those patients who are readmitted and those who are not, it is important to look at limitations of this model and possibilities for future research. Improving the discriminant function of the model is important. Of particular interest, for example, is whether involvement in a cardiac rehabilitation program, or whether discharge to the persons home, nursing home or follow-up by a home health agency would influence readmission rates.

4. The practical benefits of a model such as this, particularly in improving discharge planning, needs to be evaluated in an on-site trial. Such a demonstration project would indicate the extent to which the model could actually be used to reduce readmission rates.

5. The use of other instruments measuring morale may add to the amount of information available about one's life satisfaction or subjective well-being.

Summary

Findings from the study indicated that at the end of the specified follow-up period, 71 patients (58.7%) had experienced at least one unplanned readmission. The variables with the strongest contribution in discriminating or predicting readmission status were: "happiness", as measured by the Affect Balance Scale, and "physical health", as measured by the Multi-level Assessment Instrument. Specifically, persons reporting a positive affect about their present circumstances, and enhanced optimism about their future, were less likely to be readmitted. Further, patients who were readmitted reported worse physical health. The variables with the strongest contribution in discriminating readmission status are rank ordered beginning with happiness, number of secondary disorders, physical health, length of stay, hope, personal adjustment, and activities of daily living. An explanation is offered for why some risk factors do not function well as predictors for hospital readmission.

Risk factor profiles should alert physicians to these patients, as intensive intervention may be appropriate. These preliminary data suggest that hospital readmission among older persons with heart disease is a complex multifaceted phenomena. Further studies should test the impacts of clinical interventions designed to reduce emergency readmissions. In addition, more data is needed regarding acceptable readmission rates among older persons with specific types of cardiovascular disease.

Some readmissions may be predictable and avoidable, and they contribute significantly to the cost of health care, and have a negative impact on morale and quality of life for patients and their families. Rehabilitation professionals must be alert to those problems that could influence rehospitalization. In the long run, rehabilitation practice will benefit, as will patient care.

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